MTS Working Group
Activity Overview

Jan. 8, 2015

GREENTECH
LEADERSHIP GROUP

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About Us

- **Greentech Leadership Group** (GTLG) is a California 501(c)(3) non profit organization focused on bringing industry and policy-makers together on cutting edge environment and energy topics. http://greentechleadership.org/
- GTLG teamed with Caltech's Resnick Institute in 2013 to develop the "**More than Smart**" (MTS) effort with the support of the Governor's Office. MTS has facilitated an ongoing open dialog among leading industry, non-profits and government leaders to identify how to integrate more DER into CA's grid more effectively.
- **California Institute of Technology** (Caltech) is a world-renowned research and education institution located in Pasadena, where extraordinary faculty and students seek answers to complex questions, discover new knowledge, lead innovation, and transform our future. Caltech was recently named the world's top university for the third year in a row.
- **Resnick Sustainability Institute** is Caltech's studio for sustainability—where rigorous science and bold creativity come together to address the toughest problems that must be solved in order to change the balance of the world's sustainability. http://resnick.caltech.edu/

MTS WG Overview

- Purpose: Provide an open, voluntary stakeholder forum to discuss core issues toward finding common ground regarding the evolution of California's distribution system and the seamless integration of DER to meet customers' needs and public policy. The results of the discussions will be for the benefit of the participants and will be made public without specific participant attribution.
- Participants: Over 50 participants representing consumers, DER technologies, related energy services, investor and public utilities, research organizations, environment & energy non-profits, power system technologies and engineering-economic consultants.
- Objectives & Accomplishments:
  - ✓ Define common parameters for the development of distribution planning scenarios for utilities to properly stress test plans and to achieve a measure of comparability among the different plans.
  - ✓ Identify and define the integrated engineering-economic analysis required to conduct distribution planning in the context of AB 327 requirements.
  - ✓ Define the potential grid end-states in the context of existing plans/roadmaps and identify the considerations regarding grid evolution to meet customers' needs and California's policy objectives.

1H 2015

  - Define the scope and parameters of an operational/DER market information exchange to facilitate an open planning process and enable R&D efforts.
  - Define distribution services associated with identified DER values including performance requirements and potential monetization methods.
  - Define new distribution operational functions (DSO) and related integration technologies (vendor neutral) to create "node-friendly" open grid

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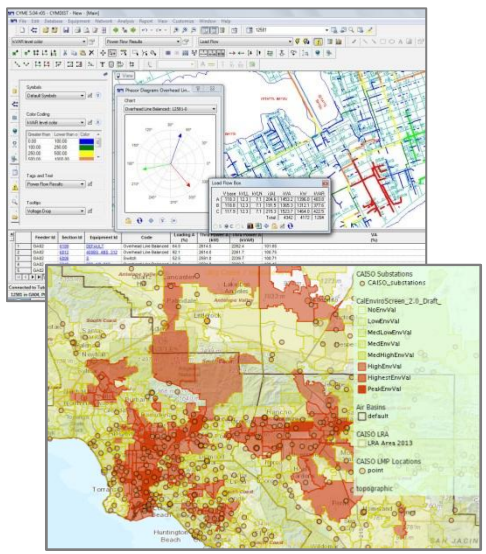
Focus: AB327 Distribution Resources Plan

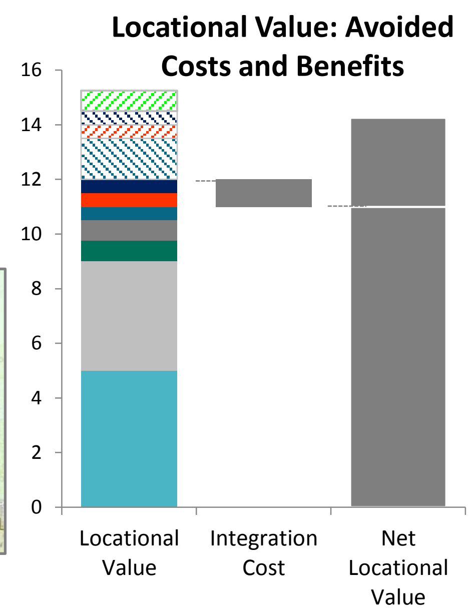
- Identifies **optimal locations** for the deployment of Distributed Energy Resources (DERs)
  - DERs include distributed renewable generation, energy efficiency, energy storage, electric vehicles, and demand response
- Evaluates **locational benefits and costs** of DERs based on reductions or increases in local generation capacity needs, avoided or increased investments in distribution infrastructure, safety benefits, reliability benefits, and any other savings DERs provide to the grid or costs to ratepayers
- Proposes or identifies **standard tariffs, contracts, or other mechanisms for deployment** of cost-effective DERs that satisfy distribution planning objectives
- Proposes cost-effective methods of effectively **coordinating existing commission-approved programs, incentives, and tariffs** to maximize the locational benefits and minimize the incremental costs of DERs
- Identifies **additional utility spending** necessary to integrate cost-effective DERs into distribution planning
- Identifies **barriers to the deployment of DERs**, including, but not limited to, safety standards related to technology or operation of the distribution circuit in a manner that ensures reliable service

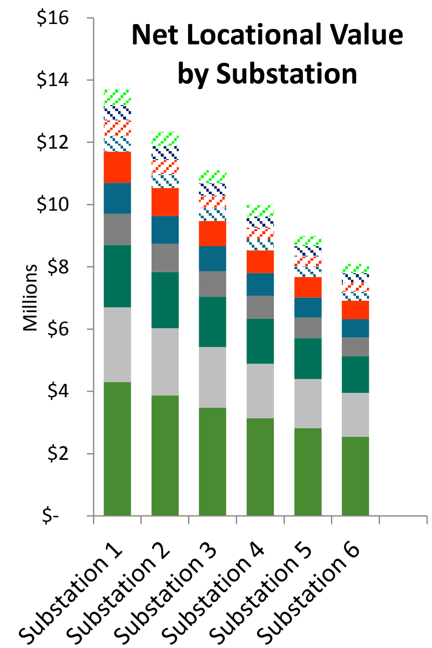
Optimal Location Values & Methodology

DRP Analysis Process

Identify DPA & Substations → Perform Planning Analyses → Calculate Locational Net Value → Rank Substations by Locational Net Value







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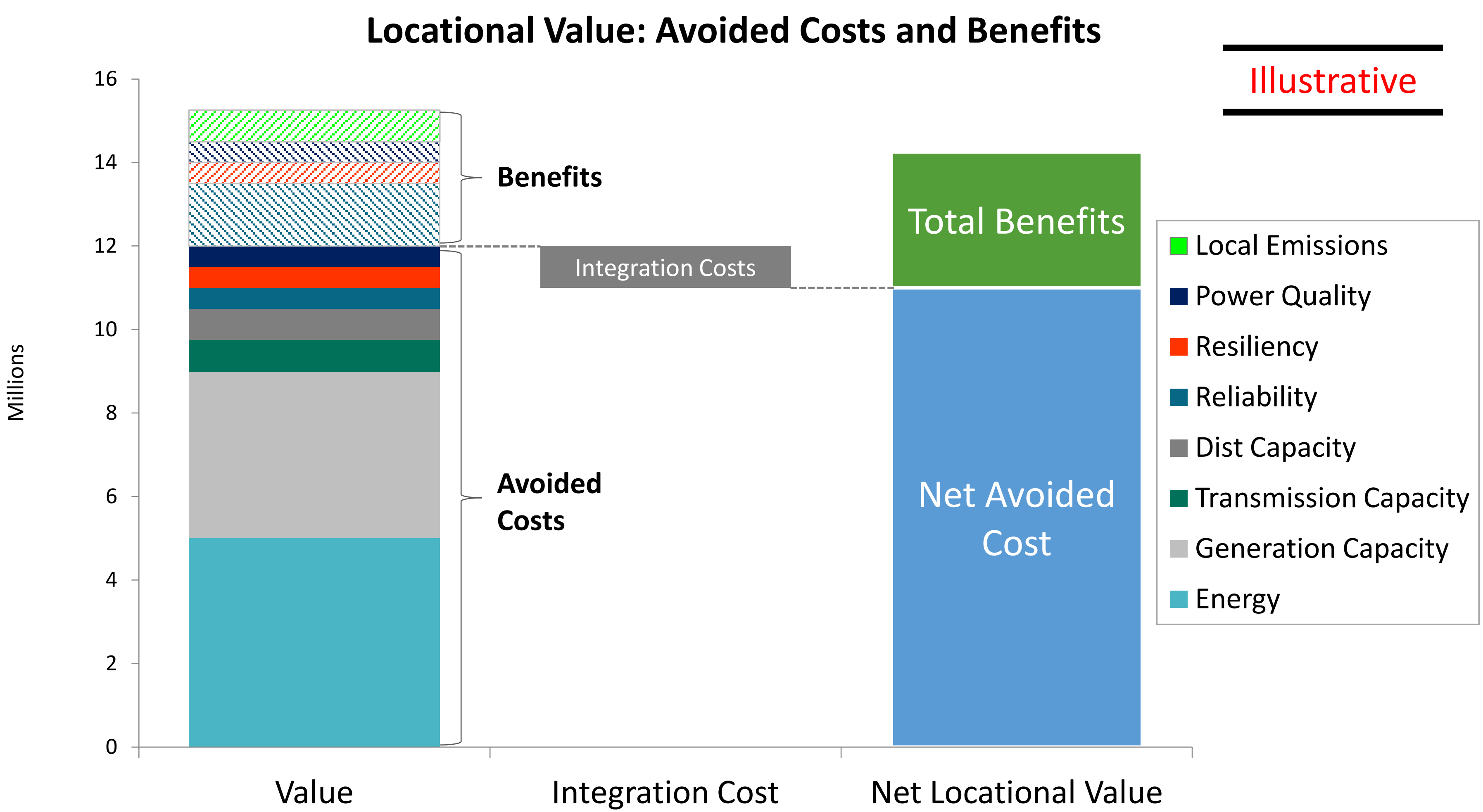
Value Analysis: Avoided Costs and Benefits



Note: Analysis excludes some avoided costs/benefits that do not have a locational dimension. Therefore, analysis is not intended to estimate full stack of avoided costs and benefits associated with DER

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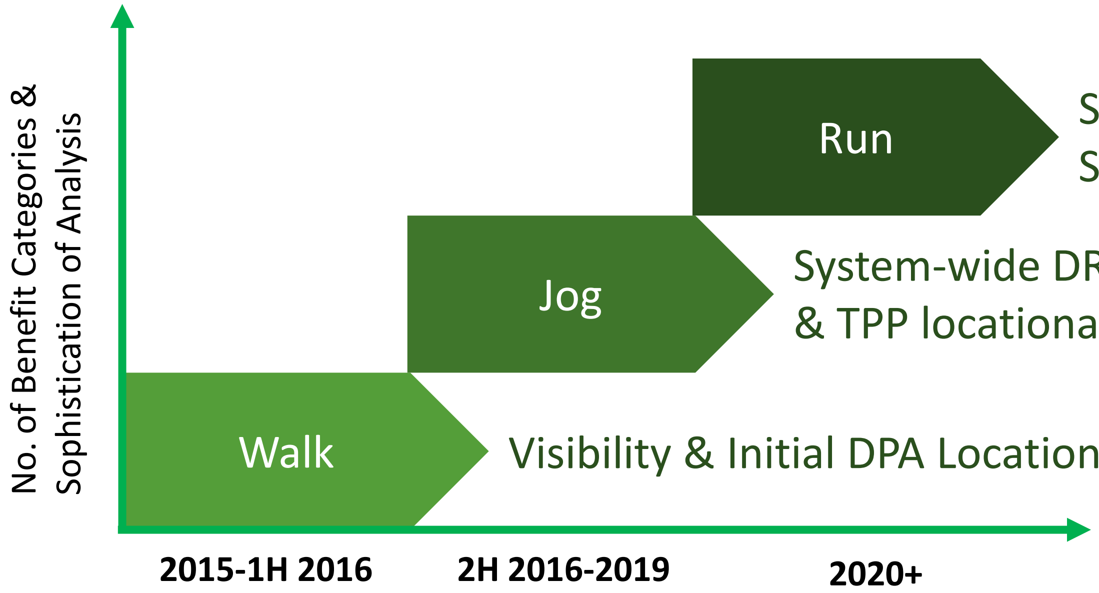
Evolution of DRP Optimal Location Benefits Analysis

- What are the immediate benefit categories that can reasonably be evaluated within the first DRP?

- What are the next logical set (incl. data and tools needed) for system-wide DRPs?



DER Value Components

	Value Component	Definition
Wholesale	WECC Bulk Power System Benefits	Regional BPS benefits not reflected in System Energy Price or LMP
	CA System Energy Price	Estimate of CA marginal wholesale system-wide value of energy
	Wholesale Energy	Reduced quantity of energy produced based on net load
	Resource Adequacy	Reduction in capacity required to meet Local RA and/or System RA
	Flexible Capacity	Reduced need for resources for system balancing
	Wholesale Ancillary Services	Reduced system operational requirements for electricity grid reliability
	RPS Generation & Interconnection Costs	Reduced RPS energy prices, integration costs, quantities of energy & capacity
	Transmission Capacity	Reduced need for system & local area transmission capacity
	Transmission Congestion + Losses	Avoided locational transmission losses and congestion
	Wholesale Market Charges	LSE specific reduced wholesale market & transmission access charges
Distribution	Subtransmission, Substation & Feeder Capacity	Reduced need for local distribution upgrades
	Distribution Losses	Value of energy due to losses bet. BPS and distribution points of delivery
	Distribution Power Quality + Reactive Power	Improved transient & steady-state voltage, harmonics & reactive power
	Distribution Reliability + Resiliency	Reduced frequency and duration of outages & ability to withstand and recover from external threats
	Distribution Safety	Improved public safety and reduced potential for property damage
Customer & Societal	Customer Choice	Customer & societal value from robust market for customer alternatives
	Emissions (CO2, Criteria Pollutants & Health Impacts)	Reduction in state and local emissions and public and private health costs
	Energy Security	Reduced risks derived from greater supply diversity
	Water & Land Use	Synergies with water management, environmental benefits & property value
	Economic Impact	State or local net economic impact (e.g., jobs, investment, GDP, tax income)

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Scope of Initial DRP (walk stage)

	Value Component	Definition
Wholesale	WECC Bulk Power System Benefits	No, no current method to determine + system-wide benefit
	CA System Energy Price	No, need integration with other CA planning + system-wide benefit
	Wholesale Energy	No, need integration with other CA planning + system-wide benefit
	Resource Adequacy	**Yes**, use existing identified Local RA to select DPA for analysis
	Flexible Capacity	No, not yet developed by CAISO
	Wholesale Ancillary Services	No, need integration with other CA planning + system-wide benefit
	RPS Generation & Interconnection Costs	No, need integration with other CA planning + system-wide benefit
	Transmission Capacity	**Yes**, use TPP capacity upgrade locations to qualitatively rank substations
	Transmission Congestion + Losses	**Yes**, use estimate in ranking substations as practical
	Wholesale Market Charges	No, need integration with other CA planning + LSE specific benefit
Distribution	Subtransmission, Substation & Feeder Capacity	**Yes**, use current distribution plans stress tested by scenarios
	Distribution Losses	No, need integration with other CA planning and advanced modeling
	Distribution Power Quality + Reactive Power	**Yes**, use current distribution investment plans stress tested by scenarios
	Distribution Reliability + Resiliency	**Yes**, use current distribution plans stress tested by scenarios
	Distribution Safety	**Yes**, use current distribution plans stress tested by scenarios
Customer & Societal	Customer Choice	No, no method to determine + customer specific & system-wide benefits
	Emissions (CO_2, Criteria Pollutants & Health Impacts)	**Yes**, use local air assessments qualitatively in ranking substations
	Energy Security	No, no current method to determine + system-wide benefit
	Water & Land Use	No, no current method to determine + system-wide benefit
	Economic Impact	No, need integration with other CA planning + system-wide benefit

DER Values & Methods (1 of 3)

		Value Granularity		Utility Avoided Cost Type		Non-Utility Benefits					
Value Category	**Definition**	**Local**	**System**	**CapEx**	**OpEx**	**Societal Benefit** (Public Externality)	**Customer Benefit** (Private)	**Possible Today** (Current Method and/or Info Source)	**Desired** (Proposed Method and/or Info Source)	**Monetization** (CPUC, CAISO, FERC, Other)	**Comments**
Distribution Losses	Estimate of value of additional marginal wholesale value of energy due to losses between the point of the wholesale transaction and the point of delivery	✓			✓			NEM 2.0 (E3) Methodology	Location/Line section specific loss reduction estimated through 1. CVR; 2. power flow modeling; or 3. locally metered loss reduction	CPUC Authorized	
Subtransmission Capacity	Reduced need for local subtransmission capacity expansion to meet customer peak loads	✓		✓	✓			Local subtransmission analysis of incremental capacity requirements	Modified planning criteria from what is currently used in the planning process that reflects the deferral value of capital.	CPUC Authorized	
Distribution Capacity (Local Substation & Feeder)	Reduced need for local distribution capacity expansion to meet customer peak loads	✓		✓	✓			Local distribution analysis of incremental capacity requirements (utility area projections; interconnection applications & studies)	Engineering-economic optimization analysis based on feeder and customer data, plus modified planning criteria from what is currently used in the planning process that reflects the deferral value of capital. This also involves an optimal portfolio analysis is performed to reduce cost and/or timelines to meet policy targets (e.g., EV adoption, Net Zero standards, and various mandates)	CPUC Authorized	Reduced future net operating and capital costs & incremental benefits related to more robust distribution system and efficient operation.
Power Quality	Improved steady state voltage control within standards and reduced transient or momentary under/over voltage and harmonics	✓		✓	✓	✓	✓	Local distribution analysis of incremental power quality requirements (utility area projections; interconnection applications & studies)	Modification to utility capital investment plans for automation and capacitors	CPUC Authorized	
Reliability	Reduced frequency and duration of distribution feeder outages typically measured in SAIDI/SAIFI	✓		✓	✓	✓	✓	DOE Interruption Cost Calculator + Utility Reliability Report	Long term goal to reflect forecasted SAIDI/SAIFI improvements as a result of grid modernization and technology integration	CPUC Authorized	
Resiliency	Improved ability to withstand and recover from external threats, i.e., cyber, catastrophic, cascading)	✓		✓	✓	✓	✓		Long term goal to develop enhanced emergency recovery plans that integrate DER as a reliable resource with utility control.	CPUC Authorized	
Safety	Improved safety as a result of new technology integration	✓			✓	✓	✓		Long term goal to reflect forecasted safety improvements as a result of grid modernization and technology integration	CPUC Authorized	

Under Discussion

Blue = NEM 2.0 Identified Values
Yellow = MTS identified value

DER Values & Methods (2 of 3)

Value Category	Definition	Value Granularity: Local	Value Granularity: System	Utility Avoided Cost Type: CapEx	Utility Avoided Cost Type: OpEx	Non-Utility Benefits: Societal Benefit (Public Externality)	Non-Utility Benefits: Customer Benefit (Private)	Possible Today (Current Method and/or Info Source)	Desired (Proposed Method and/or Info Source)	Monetization (CPUC, CAISO, FERC, Other)	Comments
Customer Choice	Customer's ability to choose alternative reliability enhancement and supply options. Societal value associated with robust		✓			✓	✓				
CO2 Emissions	The cap-and-trade allowance revenue or cost savings due to reductions in carbon dioxide emissions (CO2)	✓			✓	✓				CPUC Authorized	
Criteria Polutants	Avoided permit costs, Cap Ex (emission controls), OpEx (GHG market, emission control operation)	✓	✓			✓		CARB; CEC Cost of Generation model; E3 GHG Calculator; NREL Emissions Health Calculator.	Marginal emission reduction value; Inclusion of lifecycle emissions costs		CARB air quality permit and GHG markets included in energy costs. Note: this isn't part of any utility
Health Benefits	Public health costs; business health costs, avoided lost work days	✓	✓			✓		NREL Emissions Health Calculator			Note: this isn't part of any utility funding authorization
Water Use	Reduced water consumption by power generation cooling	✓	✓			✓		DOE estimates based on avoided generation and fuel type			Note: this isn't part of any utility funding authorization
Land Use	Permit market costs; real estate value	✓				✓		Estimates based on avoided capacity, plus fuel extraction & delivery	Standard marginal values specific to location		Note: this isn't part of any utility funding authorization
Improved Energy & Water Security	Reduced risks derived from gretare supply diversity, transportation electrification and syneries with water		✓			✓					Note: this isn't part of any utility funding authorization
Jobs	Direct, Indirect, and Induced employment (increased economic activity, decreased unemployment related costs)	✓	✓			✓		NREL Jobs and Economic Development Indicator (JEDI) input/output model [State	JEDI adjustments for local specificity		Note: this isn't part of any utility funding authorization
Economic Impact	State or local net economic impact (investment, income, GDP, public revenue [tax & fee income])	✓	✓			✓		NREL Jobs and Economic Development Indicator (JEDI) model; Berkeley Energy and	JEDI adjustments for local specificity		Note: this isn't part of any utility funding authorization

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DER Values & Methods (3 of 3)

		Value Granularity		Utility Avoided Cost Type		Non-Utility Benefits					
Value Category	Definition	Local	System	CapEx	OpEx	Societal Benefit (Public Externality)	Customer Benefit (Private)	Possible Today (Current Method and/or Info Source)	Desired (Proposed Method and/or Info Source)	Monetization (CPUC, CAISO, FERC, Other)	Comments
WECC Regional System	WECC Regional bulk power system benefits not reflected in System Energy Price or LMP		✓		✓	✓					Value associated with CA DER participation in or impact on WECC regional markets
Thermal Generation (System Energy Price)	Estimate of marginal wholesale system wide value of energy (valued at $0/MWh when renewables are on the margin)		✓		✓			NEM 2.0 (E3) Methodology		CPUC Authorized	
Locational Transmission Losses & Congestion	Avoided locational transmission losses and congestion	✓			✓			System energy price forecast from NEM 2.0 minus specific LMP nodal price estimate		CAISO	
Ancillary Services	Reduced system operations and reserves (or costs) required for electricity grid reliability		✓		✓			NEM 2.0 (E3) Methodology		CAISO	
RPS Generation & Integration Costs	Cost reductions from being able to procure RPS energy at lower prices, procure a lesser amount of energy and capacity, and reduced costs of integration		✓		✓	✓		NEM 2.0 (E3) Methodology		CPUC Authorized	Ratepayer, and Public Good (RPS targets, reduced emissions, improved economic impact)
System Capacity	The reduced reliability-related cost of maintaining a generator fleet with enough capacity to meet annual peak loads and the planning reserve margin	✓		✓	✓			NEM 2.0 (E3) Methodology		CAISO	
Transmission Access Charges	LSE avoided Transmission Access Charges (subject to FERC tariff change that rebalances costs)		✓				**Specific LSE benefit**	HV & LV TAC Tables; CAISO (BriefingLong-TermForecastTransmissionAccessCharge), IEPR TAC projections		CAISO TAC Tariff	
Transmission Capacity	Reduced need for system & local area transmission capacity	✓		✓				TPP analysis, & [average] marginal cost of new transmission capacity	Require some modified regional transmission criteria that would be acceptable by NERC standards for reliability. Would require additional study to determine the reliability of counting on DER to meet standards.	FERC	

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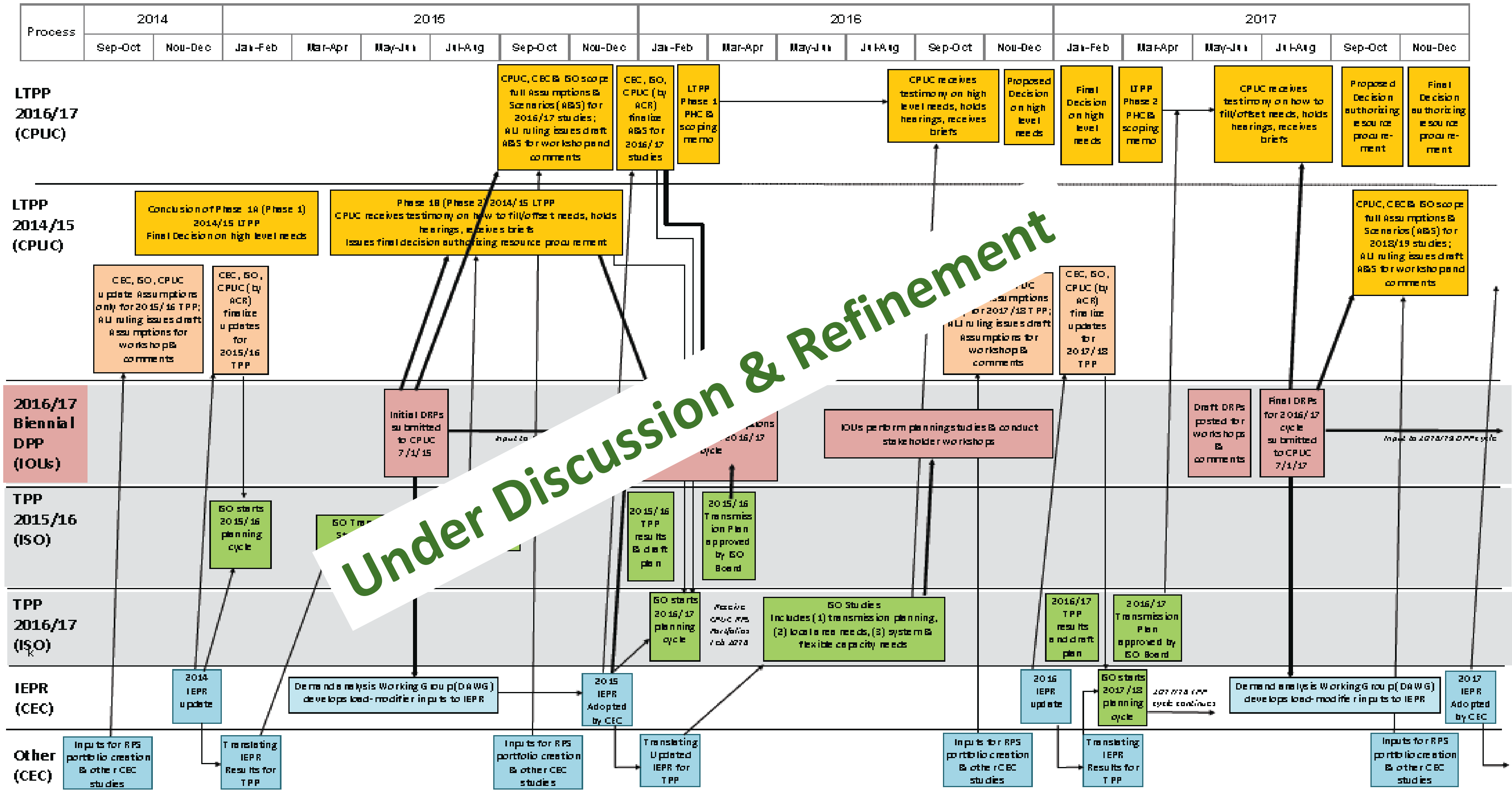
DPP Alignment Map for CPUC, CAISO, CEC

Potential Alignment of Biennial DPP with LTPP, TPP and IEPR – DRAFT #2 *12/9/14*



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